Why ISO 9000 could make or break your company
PAGE 40

Chip makers may get a tax break in '92
PAGE 11

Multichip modules to spawn $18 billion market
PAGE 48

A CAHNERS PUBLICATION

# Electronic Business

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES WORLDWIDE

JANUARY 27, 1992

## 10 companies that are...

Chun P. Chiu
President and CEO
Quality Semiconductor

Davidi Gilo
President and CEO
DSP Group

Eli Harari
President and CEO
SunDisk

David A. Laws
President and CEO
QuickLogic

Gerald Rogers
President and CEO
Cyrix

*Even in a flat-footed 1992, these up and comers are poised to call the tune for their markets*

PAGE 20

# ...PUTTIN' ON THE RITZ

Chi-Shin Wang
President and CEO
Integrated Information Tech.

Steve Pittman
Chairman and CEO
nChip

Alex Malaccorto
President and CEO
MiniStor Peripherals

Jin H. Kim
President
PI Systems

David Angel
President and CEO
Information Storage Devices

# Electronic Business

VOLUME 18, NUMBER 2 | FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES-WORLDWIDE | JANUARY 27, 1992

Cover photo by Christopher Springmann

Leading our up and coming companies are (standing, left) David A. Laws, president and CEO, QuickLogic; Gerald Rogers, president and CEO, Cyrix; Chi-Shin Wang, president and CEO, Integrated Information Technology; Steve Pittman, chairman and CEO, nChip; Alex Malaccorto, president and CEO, MiniStor Peripherals; and (kneeling, left) Chun P. Chiu, president and CEO, Quality Semiconductor; Davidi Gilo, president and CEO, DSP Group; Eli Harari, president and CEO, SunDisk; Jin H. Kim, president, PI Systems; and David Angel, president and CEO, Information Storage Devices

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**20 Puttin' on the ritz**

They aren't the industry's biggest, richest, or most profitable companies by a long shot. But we think these 10 up and comers are a solid bet to waltz through a flat-footed market


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**17 Prices** The component price slide is over



PAGE 11 Faster equipment depreciation promises $450 million a year for chip makers


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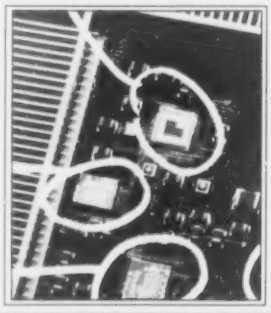
The biggest threat posed by the emerging global quality standard isn't European protectionism. It's the confusion about what it really means to U.S. electronics companies

**48 What are multichip modules and why should you care?**

A new form of hybrid IC will be an $18 billion market by the year 2000, as 30% of all chips will be sold as part of a module


PAGE 48 Pacific Microelectronics designed a multichip module for telecom/datacom processing at 622 MHz that includes CMOS, gallium arsenide, and emitter-coupled logic (ECL) die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# A refreshing look at the electronics future

TIRED AND depressed by all those doom-and-gloom forecasts for the "matured" electronics industry? Here's a welcome antidote: the tales of 10 young companies with their fingers squarely on the pulse of the technological future. Yes, Virginia, there is a start-up community.

**Senior editor Teri Sprackland**

In writing the cover story for our "Up-and-Comers" issue, senior editor Teri Sprackland covers a broad range of technologies from digital signal processing to multichip modules, and West Coast managing editor Hugh Willett provides a market perspective on the jockeying by chip makers, systems houses, and contract manufacturers for what could become an $18 billion worldwide multichip market.

While Teri found differences in the ranks of up-and-comers, she found agreement on which markets are most worth the risk: videoconferencing, multimedia, and PCs for the "virtual office" of the future. These start-ups also share the same cadre of founding investors. Apparently, start-up fever is hard to shake.

While the up-and-comers try their wings, established U.S. electronics companies are facing a new quality-assurance challenge in what they had hoped would be a booming European market. Senior editor Peter Burrows sets out to clear the air with his story on the ISO 9000 standards adopted five years ago in Brussels and due for implementation this year. He reports that confusion over the standards—not surprising considering the number of nations involved—may be a bigger hurdle than the standards themselves. U.S. companies have been slow to educate themselves about ISO 9000 and are hitting the panic button in fear that certification may give their competitors the edge. Peter's report includes a set of guidelines that executives can use to get a foot in the door.

Another multinational arena is the market for systems integration. European senior editor Barbara Berkman and stateside senior editor Rick Whiting take the measure of that market, both in terms of cash volume and of competitive jostling. And there's plenty of jostling going on, as consultants and OEMs court corporate users with buzzwords like "decentralization" and "client-oriented." In Europe, at least, it appears that OEMs, for all their financial clout, may be crowded out by enterprising consultants who focus on business dynamics as well as the latest hardware and software.

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up networks now operated by the National Science Foundation, NASA, the departments of Energy and Defense, and government laboratories.

Expanding the scope of HPCC will help win public support for the project and encourage the private sector to participate, said Apple Computer CEO John Sculley, current CSPP chairman. "This is building the foundation for the economy of the future," he said. Joining Sculley in presenting the report were Digital Equipment president Ken Olsen, Hewlett-Packard CEO John Young, Cray Research CEO John Rollwagen, and others.

The executives urged that the HPCC initiative include the development of such "enabling technologies" as new computer architectures, communication protocols, software and algorithms, and advanced microelectronics needed to support a broader range of applications for HPCC. Industrial policy advocates have long argued that the government should aid in the development of such technologies to help maintain U.S. competitiveness in world markets. The CSPP maintains, however, that the document is not a proposal for an industrial policy, something long opposed by the White House in general and Darman in particular.

*—Rick Whiting*

**STRATEGIES**

## Why multinationals have the edge on domestic companies

IF YOU suspected it was true, now a study confirms it. U.S. multinationals during the 1980s grew faster and were more prosperous than their domestic counterparts. Furthermore, the factors that made this a trend in the '80s have become a competitive imperative for the 1990s.

The study of manufacturing companies, conducted by The Conference Board in New York, finds that among all public companies with $10 million or more in sales, multinationals' revenue grew at an 8.8% average annual rate from 1979 to 1989, compared with 5.5% growth for purely domestic companies. Profits were also higher for multinationals—companies with foreign plants or sales—compared with those selling only in the U.S. (see table).

**Multinationals out-perform domestic companies**

(Annual averages, 1979-1989)

| Industry | Sales growth | | Profit rate | |
|---|---|---|---|---|
| | Multinational | Domestic | Multinational | Domestic |
| All manufacturing | 8.8% | 5.5% | 9.4% | 7.1% |
| Electronics & electrical | 8.4 | 3.8 | 7.9 | 3.7 |
| Computers & nonelectrical | 6.9 | 3.6 | 8.5 | 2.7 |
| Instruments | 8.3 | 5.7 | 8.7 | 6.2 |

Source: The Conference Board

In high-tech, the profit gap was even larger. Electronics and electrical equipment multinationals' profit rate averaged 7.9% compared with 3.7% for domestic companies. Nonelectrical machinery makers, which includes the computer industry, saw multinationals' profit rate hit 8.5% while domestic companies profits stalled at a 2.7% rate.

Why do multinationals prosper so? The outstanding companies in the study, those with above-average growth and profitability, had several common characteristics. The companies were large and had twice the market share of the average company. They were twice as likely to have operations in the fast-growing Pacific Rim. They were much more likely to engage in R&D outside the U.S. Also, the above-average performers were concentrated in the capital goods and the dynamic, competitive electronics industry.

Multinationals accounted for 53% of all companies studied in 1989 and 89% of all worldwide sales, according to Charles R. Taylor, executive director of the Group of Thirty in Washington, D.C., and the author of the study. The 1980s, of course, saw a rapid increase in global activity for a number of reasons. Technology innovations reduced the cost of transportation and communication, and the need to be in local markets in order to influence emerging technology standards became a driving force.

*—E. B. Baatz*

**RESEARCH AND DEVELOPMENT**

## R&D superstars sought for annual award

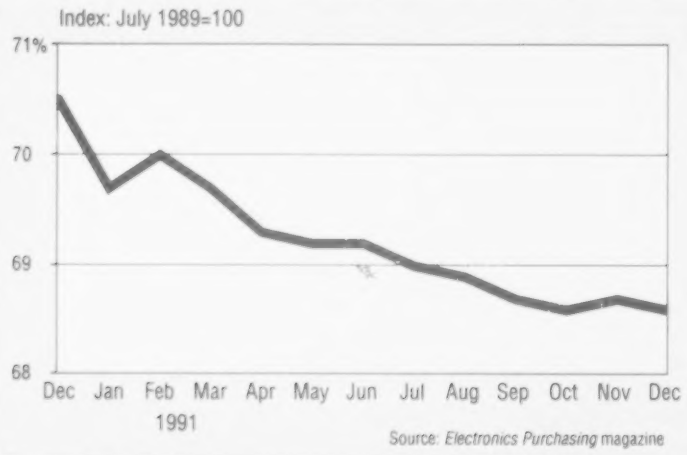
EVER HEAR OF the "zap-out end?" How about the "Telecopier 200 Facsimile Transceiver?" The two products have more in common than the fact that they both went on to become widely recognized by names other than the ones their developers originally gave them.

The "zap-out end" (or pop-top can) and the "Telecopier 200" (or Xerox's original fax machine) were both winners of *R&D Magazine*'s R&D 100 Award. Since 1963, the Cahners Publishing Co. magazine has recognized the 100 most technologically significant new products of the year.

This year, the R&D 100 program is soliciting entries from around the world. Products, which include software, processes, and instruments must have been available for purchase or licensing during the 1991 calendar year. Entries are judged by a panel of scientists, industry experts, and editors of *R&D Magazine*.

Deadline for entries are Mar. 2, 1992. For entry forms, contact: Ms. Tina Lenz, R&D 100 Coordinator, P.O. Box 5080, Des Plaines, IL 60017-5080 USA; or fax: (708) 390-2618.

## Semiconductor prices linger at low levels...

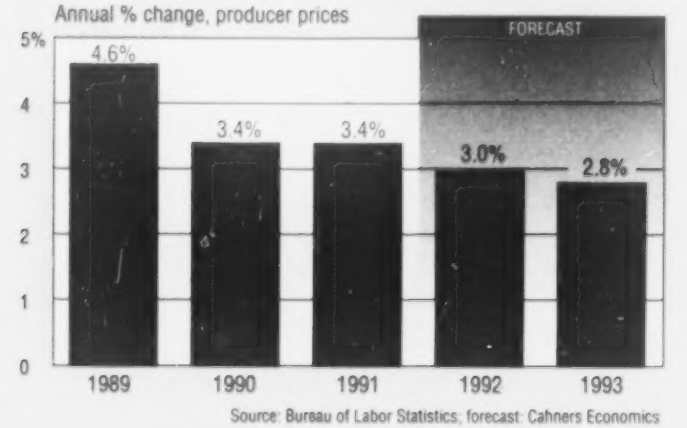



Source: *Electronics Purchasing* magazine

## ...and downward pressure on price still exists...

Source: *Electronics Purchasing* magazine

## ...while aggregate inflation remains low




Source: Bureau of Labor Statistics; forecast: Cahners Economics

PRICES

# The component price slide is over

THE ELECTRONIC component price slide that devastated many component manufacturers in 1991 appears to be over. A monthly survey of buyers from sister publication *Electronics Purchasing* shows that semiconductor prices held steady last year, albeit steady at record low levels. The semiconductor price index (July 1989 = 100) registered 68.6 in December, the 10th consecutive month the index hung around the 70 mark. The components price diffusion indicator confirms the recent trend of stable prices and suggests that pressure to raise prices still does not exist. The indicator stood at 48 this past December, the seventh consecutive month below 50 (a value less than 50 implies downward pressure on prices.)

One reason why prices won't be heading up anytime soon: Buyers at electronic companies still have no plans to build up inventory; 42% of the survey respondents plan to maintain their current inventory levels and 48% intend to reduce inventory stockpiles over the next 90 days.

Other evidence suggests component prices will most likely remain firm at their current low levels. Shipments of electronic components are forecast to rise 8.7% in 1992. While that's stronger than the 2.5% gain seen in 1991, it's not enough to suggest across the board price increases. Furthermore, operating rates for all manufacturers are currently running at just 78.6%, and are forecast to rise only slightly by the end of this year. Finally, the overall economic environment will not see a resumption of inflation in 1992. In sum, continued price deflation remains a bigger worry than price inflation. For electronic components, at least, with any luck prices will be holding firm in 1992 as they did at the end of 1991.

—*Julie Handelman-Sagan*

# PUTTIN' ON THE RITZ

They aren't the biggest or the richest, but these 10 up and comers are good bets to defy this year's flat-footed market

By Teri Sprackland

Chun P. Chiu
President and CEO
Quality Semiconductor

Davidi Gilo
President and CEO
DSP Group

David A. Laws
President and CEO
QuickLogic

Gerald Rogers
President and CEO
Cyrix

Steve Pittman
Chairman and CEO
nChip

Many changes have rocked the U.S. electronics industry during the two years since ELECTRONIC BUSINESS last picked its list of "up and coming" companies. The nation has been mired for a year and a half in a particularly stubborn recession that still shows few signs of winding down in the U.S., even as it takes aim on Europe and Japan. Venture capital funding has been slashed by more than half during the past two years, according to one source. Fast-moving technologies have turned yesterday's electronic innovations into the most basic commodities. The industry has been wrenched by slumping sales, plummeting prices, and skyrocketing capital requirements.

The entrepreneurial spirit, however, is far from dead in U.S. electronics (although the cherished image of the "lone rider" has given way to one increasingly shaped by strategic alliances and partnerships). A surprising number of companies, large and small, are being driven to take their new ideas, new end markets, and new applications to the very limits of the technological spectrum. In some cases, successful entrepreneurs have staked their reputations, and their personal fortunes, on

Eli Harari
President and CEO
SunDisk

Chi-Shin Wang
President and CEO
Integrated Information Tech.

Jin H. Kim
President
PI Systems

Alex Malaccorto
President and CEO
MiniStor Peripherals

David Angel
President and CEO
Information Storage Devices

Christopher Springmann

the line. The real problem in putting together this report was not in finding 10 companies that could be described as "up and comers"—it was to keep the number to *only* 10.

Admittedly, none of these companies are guaranteed to succeed in their respective niches, and relatively few are destined to become industry giants. None topped $50 million in sales last year; several of them are only now beginning to ship their first products. Nevertheless, we expect that their proven technological resources, creative positioning in their markets, strong financial backing, and seasoned management teams will have most of them stepping out smartly within the next year or two. □

## Cyrix

Richardson, Tex.
**Started:** 1988
**Key Products:** Math coprocessor for the x86 PC family
**Estimated 1991 revenue:** $50 million
**Management:** Gerald D. Rogers, president, and CEO
**Ownership:** Berry Cash Southwest Partnership; InterWest Partners III; Sevin Rosen Bayless Borovoy; SRB Partners Fund
**Funding:** $4 million
**Employees:** 125
**Primary strength:** Strong profits from value-added standard product in a big market

CYRIX MADE $25.2 MILLION IN SALES and more than $4 million in profits in 1990, its first year on the market with a math coprocessor that ran at least 20% faster than Intel's. In 1991, sales were expected to close at near or more than $50 million.

**Cyrix aims to sell its speedy coprocessor in Japanese markets, according to CEO Rogers**

The strategy of targeting Intel is similar to the way in which Compaq went after IBM. Not coincidentally, one of Cyrix's lead investors happens to be L. J. Sevin, who also helped Compaq on its way. CEO Rogers says Cyrix is targeting Japan as a market where it hopes to gain name recognition and stature, because competitor Intel is not as established there as in the U.S.

Cyrix could really make a name for itself if, as industry rumors have said for months, the company introduces a 386-compatible microprocessor to compete with Intel's flagship version. It's not clear just how Intel will react to the move, but if history is a judge, it can be expected to throw up as many legal obstacles as possible. However, Cyrix has not backed away from the challenge yet, and has organized its marketing plan to cope with Intel's well-known propensity to cut prices once competitors enter its markets. □

## DSP Group

San Jose, Calif.
**Started:** 1987
**Key Products:** Digital signal processing-based chipsets for personal communications
**Estimated 1991 revenue:** $10 million
**Management:** Davidi Gilo, chairman, CEO, and president; Shabtai Aldersberg, founder and corporate VP for advanced technology
**Ownership:** Company employees; Nikko Capital Co.; Kenwood Corp.; Poly Ventures; Maruban Corp.
**Funding:** $12.8 million
**Employees:** 100
**Primary Strength:** Excellent partnerships and well-received products in a consumer market with explosive growth projections

THE DSP GROUP'S product list includes chipsets for cellular telephones, faxes, telephone answering machines, and dictation machines. Sales have climbed from $6 million in 1989 to $11 million in 1990. The company expects to post its first profit this year.

**DSP Group's Gilo is banking on digital phone-answering machines to keep sales figures climbing**

The digital signal processing (DSP) chip market is growing at an annual rate of 36%, according to Will Strauss, president of Forward Concepts, a market research firm in Tempe, Ariz. That well outpaces the growth rates within the overall semiconductor market. Strauss predicts that DSP chip sales will reach $3 billion by next year.

To some extent, the DSP Group's fortunes hang on the future of digital answering machines. Those devices account for less than 5% of the more than 17 million machines sold in 1991 and store only a few minutes of messages. Strauss predicts that as technology improves, the prices of digital machines will plummet, making conventional tape answering machines virtually obsolete by 1995.

The DSP Group's products combine its appli-

cation specific ICs and proprietary algorithms with Texas Instruments's core DSP and support peripherals. The company's technological expertise in data compression, timescale modification, noise reduction, speech detection and recognition, and echo cancellation have impressed both partners and customers. □

## Information Storage Devices

San Jose, Calif.
**Started:** 1987
**Key Products:** Nonvolatile direct analog storage chip
**Estimated 1991 revenue:** $5-$10 million
**Management:** David Angel, president and CEO; Richard T. Simko, chairman and founder; Michael Geilhufe, founder and VP of manufacturing
**Ownership:** Applied Technology Partners; ASCII Corp.; AVI Management Partners; company executives
**Funding:** $8 million
**Employees:** 20
**Primary strength:** First to develop nonvolatile analog storage chips

UNIQUELY POSITIONED AS THE only company that has cracked the problem of storing analog signals directly on a floating gate of an MOS transistor, ISD's biggest problem may be deciding which market to pursue first. If costs can be cut as production increases, the company's chips could end up in everything from toys to airport guidance devices. The company has received two patents in analog storage techniques; eight others are pending. Markets now being explored are primarily in communications—pagers, annunciators, and embedded cellular telephone answering/memo devices.

**Information Storage Devices' Angel claims the company's chip will stall tape-based and digital phone-answering machines**

"I have no doubt that our chip will stall all-digital answering machines while it eliminates tape-recording mechanisms in the mid-range models," says founder Richard Simko, who maintains that the analog chip will be a whole new animal to the technological zoo. Analyst Strauss agrees that the technical achievement is impressive. The next hurdles are to cut the cost of the device and increase the length of the recording from the 20 seconds now possible on each chip. At present, chips can be cascaded to increase storage lengths.

Sanyo Semiconductor Corp. in Mountain View, Calif., has signed on as a customer. Sanyo president Tsuyoshi Taira says he believes the first application in the next year or so will be for the outgoing-message portion of answering machines. ISD is fabless, with several foundry agreements. □

## Integrated Information Tech.

Santa Clara, Calif.
**Started:** 1987
**Key Products:** Math coprocessor and PC graphics chips; data compression for information storage, video teleconferencing, and multimedia
**Estimated 1991 revenue:** $30-$35 million
**Management:** Chi-Shin Wang, president and CEO
**Ownership:** ASCII Corp.; General Electronics; Mitsui; Yamaha
**Funding:** $2.8 million
**Employees:** 100
**Primary strength:** Strong sales in thriving math coprocessor market. Engineering strength in growth markets in data and video compression

CEO CHI-SHIN Wang proudly points to the fact that his company is the only alternate supplier in Intel's math coprocessor market not to become entangled in legal battles—a definite savings in legal costs compared with other players, such as Cyrix. The company also is working on data compression processors for information storage and retrieval and video compression processors for teleconferencing and emerging multimedia applications. Its latest product is a programmable video signal processor that allows multimedia computer and video communication to be integrated on the same hardware. It also is developing chips for picturephones.

**Integrated Info. Tech. is Intel's only rival in math coprocessors to avoid costly legal wars, notes CEO Wang**

IIT's biggest customer in its evolving video compression business is market leader Compression Labs Inc. Wen Chen, Compression Labs' executive vice president of R&D, waxes eloquent about the potential of the technology. "The market is mushrooming, becoming a booming area with applications well beyond teleconferencing," he says.

Michael Slater, editor of *The Microprocessor*

*Report* in Sebastopol, Calif., expects video compression engines to be implemented as add-in boards for PCs in the near future. "If compelling desktop video applications emerge, compression chips could become standard in desktop computers," he says. □

## MiniStor Peripherals

San Jose, Calif.
**Started:** 1991
**Key Products:** 1.8-inch disk drive
**Estimated 1991 revenue:** none
**Management:** Alex Malaccorto, president and CEO
**Ownership:** Kleiner Perkins Caufield & Byers; Institutional Venture Partners; Grace Venture Corp.
**Funding:** $12-$14 million
**Employees:** 70
**Primary strength:** Well-defined niche in young market, plus strong financial backing to stand up to competition

**MiniStor's Malaccorto can expect competition from other makers of high-capacity, small form factor drives**

THE YOUNGEST OF this crop of up and comers, MiniStor targets emerging sub-notebook and handheld computer data storage markets. The company plans to later expand into office records storage and undisclosed "unconventional" disk drive markets.

One problem facing the company is that no electronics industry segment is less palatable to investors than disk drives. The sector has been wracked by fierce boom-bust swings that test the G-force limits of new entrants and wreak financial havoc on established ones. MiniStor nevertheless is forging ahead with its large-capacity (60-Mb), credit card-size drives by the third quarter of this year. Watch for plenty of heat from established small-form factor market heavyweights like Conner Peripherals Inc. and Quantum Corp., as well as from start-up Integral Peripherals Inc. in Boulder, Colo., which focuses on low-end 20- and 40-Mb drives. Despite the ferocious competition, the relentless push toward smaller form factors in the high-growth portable PC market is alluring

The company has managed to grab $5.4 million in its first round of venture capital investment, according to CEO and president Alex Malaccorto, and expected another round of up to $7 million before the end of 1991. Kleiner Perkins Caufield & Byers and Institutional Venture Partners each contributed $2 million on the first round; the balance was provided by Grace Ventures Corp. and other minority investors. Malaccorto says the second round would get MiniStor through the pre-production stage, and that an additional $7 million needed by July will put the company into production at a new facility in Singapore. □

## nChip

San Jose, Calif.
**Started:** 1989
**Key Products:** Multichip modules
**Estimated 1991 revenue:** $3-$6 million
**Management:** Steve Pittman, chairman and CEO; Bruce McWilliams, senior VP and chief technical officer; David Tuckerman, VP technology
**Ownership:** Mohr, Davidow Ventures; Kleiner Perkins Caufield and Byers; Mayfield Fund; Comdisco Venture Leasing Group; Sumitomo Metal Mining
**Funding:** $11 million
**Employees:** 50
**Primary strength:** Ground-floor position in fast-growing, high-volume market. Technical expertise to stay ahead of current customer requirements

MULTICHIP MODULES HAVE BEEN used in mainframes for years. The concept is developing new momentum, however, because faster system clock speeds force microprocessor designers to find ways to improve the speed between chips. Modules provide a substrate technology that improves system performance.

nChip's customer base includes NexGen, which is working on a 486-performance level microprocessor, and Control Data Corp. Semiconductor companies, including possibly Intel Corp., are working on developing their own capabilities, but there is a niche for an independent supplier who serves customers who want to combine chips from different suppliers onto one substrate. The only company in this year's group to own its own fab, nChip has a San Jose fab with 6,000 square feet of clean room. Because substrate is less demanding in some

**Led by CEO Pittman, little nChip has set out to become a billion-dollar vendor of multichip modules by the year 2000**

ways, the company's 2-micron geometry is sufficient and less costly than state-of-the-art fabs, says CEO Pittman.

Dataquest predicts that by the end of the decade, the multichip module business will capture 8% of all chips, with $8 billion from the substrate content. "We plan to be a billion-dollar company, and capture at least 10% of that business, by the end of the decade," says Pittman. Revenue was $5 million in 1991 and company executives predict sales of $10 million to $20 million in 1992. □

## PI Systems

Portland, Ore.
**Started:** 1990
**Key Products:** Lightweight proprietary pen-based computer and software
**Estimated 1991 revenue:** $28 million
**Management:** Jin H. Kim, president and cofounder; Chris Rosebrugh, VP engineering/cofounder; Eng-kee Kwang, VP software development/cofounder
**Ownership:** Asian venture capital, including Tong Yang Group of Korea; private investments
**Funding:** $5 million
**Employees:** 26
**Primary strength:** Lined up to capture a vertical, high-volume mass market

PI SYSTEMS IS ONE OF THE FIRST vendors to introduce a pen-based computer to the market. Unlike other start-ups—such as Momenta Corp., Tusk Inc., and NCR Corp., which target horizontal PC markets—PI is taking aim at modestly high-volume vertical market applications with a low-functionality, pen-based system designed to replace clipboards and paper forms.

**Unlike his rivals, PI Systems' Kim targets high-volume vertical markets for his company's pen-based computers**

PI's system also weighs much less than the competition—three pounds, versus six- to eight-pound boxes from Momenta and Tusk. Weight is a critical factor in selling systems designed for applications that require it to be lugged around most of the day. PI expects to be in full production this quarter with hardware and software integrated packages selling for under $2,000.

Analysts are convinced that pen-based computer systems will be the next wave of computing as users adapt to the intuitive ease of use of the pen as an input device. By 1995, International Data Corp. predicts, the market will grow to $1.6 billion, up from an estimated $350 million this year. That market will initially grow in the vertical segments targeted by PI. □

## Quality Semiconductor

Santa Clara, Calif.
**Started:** 1989
**Key Products:** High performance CMOS logic, static RAMs, FIFOs, and innovative products packaging marketed to workstation, high-end PC, datacom, graphics, and telecomm markets
**Estimated 1991 revenue:** $12-$15 million
**Management:** Chun P. Chiu, president and CEO; Manohar L. Malwah, senior VP technology and manufacturing
**Ownership:** Employees, private investors, and Institutional Venture Partners
**Funding:** $9 million
**Employees:** 70
**Primary strength:** Experienced management, excellent understanding of Japanese markets, strong engineering talent in high-end SRAM and logic markets

QSI IS ON THE LEADING edge of fast SRAMs, a value-added niche that led companies such as Cypress Semiconductor to fame and glory, as well as high-end logic. The company is now growing into a $1 million a month business.

**At Quality Semiconductor, CEO Chiu offers fast SRAMs as an entry into new market niches for the company**

QSI's strategy is to go after existing sockets with higher performance parts, then create new niches that can be developed. The company offers higher performance standard SRAMs to get initial orders, for example, then plans to follow with specialty items that solve specific engineering problems and get its parts designed in as a sole source. One new product solves ground bounce problems which are becoming more of a headache at higher clock frequency designs. Markets targeted are mostly in high-end workstations.

Customers include Solectron Corp., a Fremont, Calif.-based 1991 winner of the Malcolm Baldrige Award. Quality Semiconductor is "a very viable competitor," says Jim Handy, senior industry analyst at Dataquest. He notes the founders' expertise from their in-

volvement in the founding of Integrated Device Technology, coupled with their close connections to the Japanese market and leading edge technology. □

## QuickLogic

Santa Clara, Calif.
**Started:** 1988 (as Peer Research Inc.)
**Key Products:** Field-programmable logic devices
**Estimated 1991 revenue:** $100,000-$500,000
**Management:** David A. Laws, president and CEO; John Birkner, Andrew Chan, H.T. Chua
**Ownership:** Sequoia Capital, Sutter-Hill, Technology Venture Investors, U.S. Venture Partners, Vertex Management
**Funding:** $5 million
**Employees:** 26
**Primary strength:** Significantly higher product performance, explosive growth market, experienced management

ONE REASON for QuickLogic's favorable position is its leadership, headed by David Laws, formerly of programmable logic leader Altera. The company was founded by the three men—Birkner, Chan, and Chua—who while at Monolithic Memories Inc. invented what may be the chip industry's most perennially popular product—the programmable array logic.

**Can QuickLogic CEO Laws steer his fast programmable logic devices through what shapes up as a crowded field?**

Although QuickLogic closed 1991's books with less than $500,000 in sales (all accrued during the last two quarters), Laws claims that 1992 sales will come in at $3 million to $5 million as sales ramp up. He projects a growth path to $15 million in 1993.

QuickLogic's advantage is speed—system performance two to three times faster than competing solutions, based on low impedance antifuse technology called ViaLink. Fab facilities are provided through a manufacturing and technology agreement with ASIC house VLSI Technology Inc. in San Jose. "There is little question that this is the fastest FPGA on the market," says one design consultant.

Despite the successes of other FPGA companies, such as Xilinx and Actel, the latest batch of FPGA companies will have a tough battle. The total market in 1991 came to only about $200 million, according to Dataquest. And Integrated Circuit Engineering Corp., a market research firm in Tempe, Ariz., notes that while FPGAs will grow at a compounded annual rate of about 40% through 1995, the market could support only eight to 10 companies. "I wonder whether the programmable logic market is overfunded," says Richard Helfrich, a founder of Vitesse Semiconductor in Pleasanton, Calif. "We may see some fratricide." □

## SunDisk

Santa Clara, Calif.
**Started:** 1988
**Key Products:** PCMCIA Rev. 1.0 & 2.0-compatible PC cards and modules that emulate disk drives
**Estimated 1991 revenue:** $3 million
**Management:** Irwin Federman, chairman; Eli Harari, president and CEO
**Ownership:** AT&T, Concord, Dillon Read, Mayfield Fund, Oak Investment Partners, U.S. Venture Partners, Western Digital
**Funding:** $13 million
**Employees:** 85
**Primary Strength:** Well designed, low-power disk drive replacement for growing portable PC market

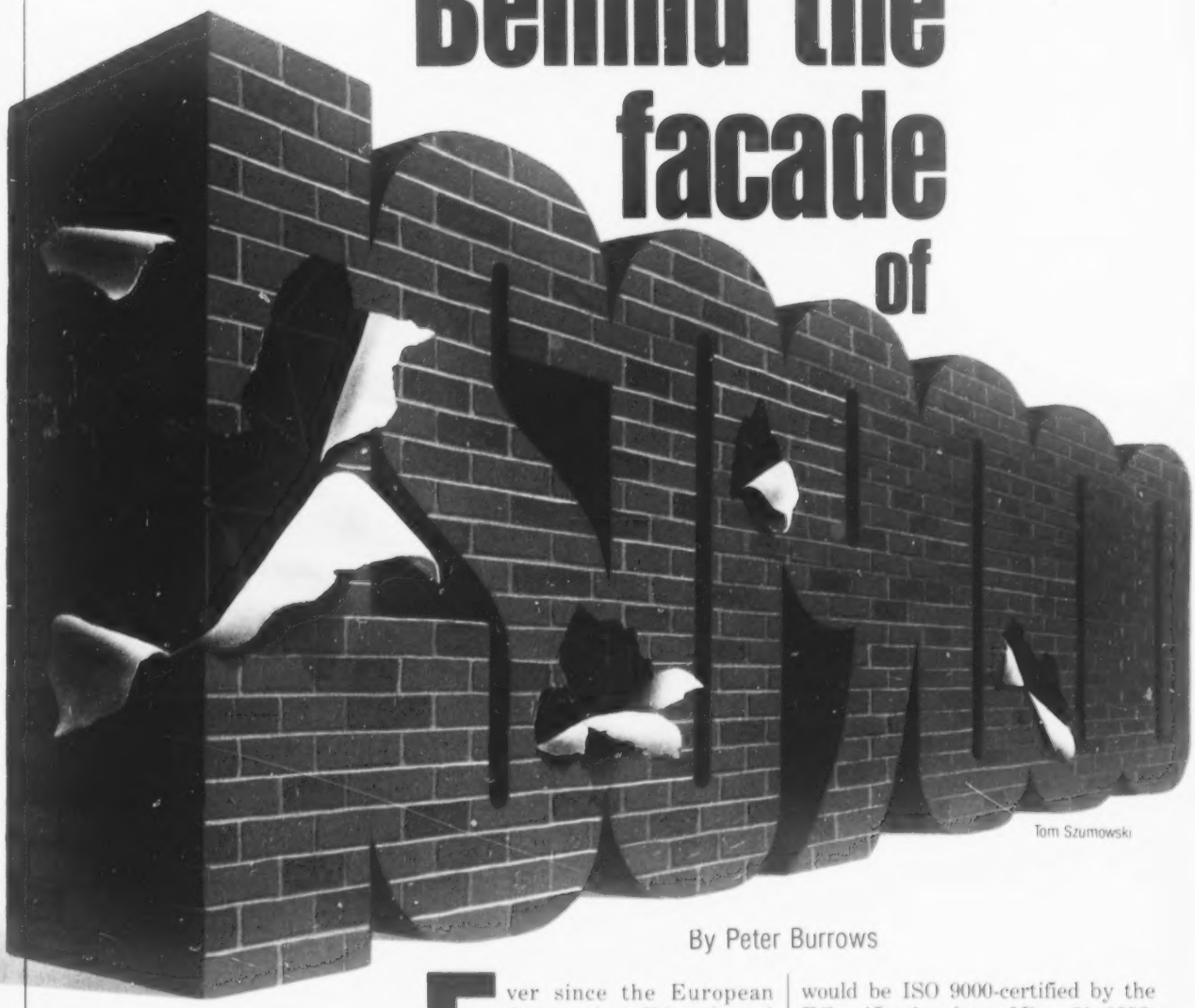
ONE OF THE HOTTEST GROWTH prospects in the computer industry, SunDisk has targeted the emerging PC card interface market with a 10-megabyte capacity memory card. The device appears like a disk drive to the host system but has no moving parts and consumes less power than conventional rotating disk drives. Although its competition could be considered to be conventional disk drives, it provides advantages—low power and ruggedness—that drives can't offer.

Initially funded by founders Irwin Federman and Eli Harari, SunDisk's first products, shipping now in evaluation quantities, are 10- and 20-Mbyte disk-drive-like storage devices.

Don't call SunDisk a semiconductor company, however—the company provides memory systems that just happen to be packaged chips, says Gib Myers, general partner with the Mayfield Fund and a second-round investor. The company expects to be profitable this year by topping $30 million in revenue. □

**SunDisk's Harari thinks the company's memory cards offer important advantages over conventional disk drives**

# Behind the facade of



Tom Szumowski

The biggest threat posed by the emerging global quality standard isn't European protectionism. It's the confusion about what it really means

By Peter Burrows

Ever since the European Community (EC) adopted the ISO 9000 quality-system-assurance standards in 1987, skeptics have warned that EC bureaucrats would use the standards to thwart outsiders' efforts to trade with the unified European market after Jan. 1, 1993, when the borders come down.

So far, though, it's been the confusion surrounding ISO 9000, not protectionism, that has hurt U.S. companies most. Although DataSwitch Corp. assured customers that it would be ISO 9000-certified by the EC unification date of Dec. 31, 1992, for example, the Shelton, Conn., company recently lost a seemingly solid $150,000 order for matrix switches with a British government agency to an ISO-compliant competitor. "We thought [the certification process] was proceeding nicely," says president and CEO Robert Gilbertson. "What can you do when the guidelines you are given don't hold up?"

In truth, the guidelines are far more complicated and less predict-

able than most executives realize. Developed by the 91-nation members of the Geneva, Switzerland-based International Standards Organization (ISO) and adopted as the national quality standard in 41 nations, ISO 9000 certification is required by an ill-defined mix of government buyers and private companies in Europe and elsewhere—either now, by year's end, or at some future date.

THE CONFUSION starts with the standards themselves. Basically, the ISO 9000 standards force manufacturers to prove they can make what they say they will make (see "The basics of ISO 9000"). That sounds simple enough, but there's plenty of room for confusion. For one thing, the standards go by several names—Q-90 in the United States, BS5750 in Britain, and EN 29000 in the EC. Also, there are three different levels of certification: ISO 9001, the broadest, sets quality guidelines for designing, developing, installing, and servicing product. ISO 9002 sets more detailed guidelines for production and installation only. ISO 9003, the least demanding, focuses only on final inspection and testing.

Nor is it clear which products ultimately will require ISO 9000 certification in order to be accepted in Europe. For now, the EC (as well as the seven-nation European Free Trade Association) demand certification only for seven highly regulated products, including toys, safety equipment, and video display terminals. The most troublesome for electronics manufacturers is a directive on telecom terminals that requires that all such products come from ISO 9000-compliant plants by Nov. 6, 1992. The directive defines the terminals as "any device that connects directly to the public networks . . . through direct or indirect connection for the purpose of sending, receiving, and processing information." That could affect 90% of U.S. computer sales in Europe, says consultant Jeff Tuthill of the National Standards Authority of Ireland, an ISO 9000 "registrar" that has recently certified Amdahl Corp. and Prime Computer Corp. Unlike some of the other seven categories, in which requirements may be satisfied by the supplier's internal quality data, the telecom directive calls for actual ISO 9000 certification by an approved registrar.

Eventually, ISO 9000 will become far more pervasive. Britain's Department of Trade now requires that a growing range of products sold to the public sector comply with the standard, and the governments of Australia, Canada, Finland, the Netherlands, Japan, and others are following suit to some degree. NATO and the U.S. Department of Defense will also require ISO 9000 compliance; the Pentagon intends to switch to ISO 9000 from MIL-Q 9858A and MIL-I 45208A by the end of 1993.

There is also a chance that the EC will add to its list of directives. Proposals to require certification for software products and measurement systems are already on the docket.

The real driving force behind ISO-9000, however, is the private sector. Few companies now require suppliers to be ISO 9000-compliant, but many are moving in that direction. A recent poll of 500 electronics purchasing executives by *Electronics Purchasing* magazine shows that, while only 14% now insist on compliance, 66% plan to do so by 1995. "At some point you'll have to be ISO 9000-certified just to stay in the game," says Joel Beck, vice president of U.S. manufacturing with Bull HN Information Systems Inc. in Billerica, Mass., a subsidiary of France's Groupe Bull. "We'll probably ask for it [from suppliers] by the end of 1992 and demand it by the end of 1993."

ALTHOUGH COMPLIANCE isn't mandatory in most cases, it is already a critical differentiator in many negotiations. "We sometimes suggest that vendors get certified," says Hans Pfander, director of quality at ITT Semiconductors in Frieberg, Germany. "We wouldn't choose a supplier just because he has a certificate, but we may choose a supplier that is

## The basics of ISO 9000

**What is ISO 9000?** It is actually a set of standards created by the 91-nation International Standards Organization (ISO) to define the basics of a quality system for manufacturing, including documentation, controls, and worker training. It is not a product certification or quality assurance system and does not replace existing product-specific regulations. Certification is granted on a site-by-site basis, not at the corporate level.

**Why is it important?** One reason is that the European Community (EC) has made ISO 9000 certification mandatory for certain classes of products, including telecommunications terminals. More importantly, many commercial and government customers (especially in Europe) require compliance from suppliers.

**Where does it apply?** In addition to product-specific EC directives, the governments of Great Britian, Canada, Australia, and other nations require ISO 9000 certification for certain classes of products. While activity is greatest in Europe, the standard also is gaining momentum in the U.S. and Japan.

**How do I comply?** The EC's telecommunications directive and many government and commercial companies require that suppliers be certified by a third-party registrar. Other companies permit suppliers to simply demonstrate compliance without third-party certification.

Source: ELECTRONIC BUSINESS

certified over one that is not."

Kris Sateesh, manager of quality control and ISO 9001 programs with GE Fanuc Automation in Charlottesville, Va., confirms that trend. "Nobody requires [compliance] right now, but British Gas and British Petroleum wouldn't buy from us until we showed them a game plan to get there," he says. "Besides, key competitors like Siemens and Philips are getting certified, so we felt we had to do it."

That's the rub facing U.S. electronics companies, especially those whose products fall on the margins of the telecom directive. Although no one can be sure that ISO 9000 will hurt non-compliant vendors, the uncertainty compels many companies to cover their bases just in case. "The real question companies must ask themselves is, 'Am I willing to take the chance when my competitors are moving ahead with it?' " says Mike Caruso, quality and reliability manager at Underwriters Laboratory Inc. in Melville, N.Y., which is now working with more than 200 companies seeking ISO 9000 certification. "If they wait to get registered and find out later that they need to redesign their quality system, it could take them years to catch up."

Considering the relatively low fees charged by registrars (from about

**DataSwitch lost a seemingly "secure" U.K. contract to an ISO-compliant rival last year, claims president and AEA chairman Robert Gilbertson**

$4,000 for a small facility to $30,000 or more for large, multilocation operations), ISO 9000 certification is relatively cheap insurance against such a scenario.

Possibly, the best reason to seek ISO 9000 certification, however, is the reason the standard was developed in the first place—to improve quality. "We invariably reduce our scrap, improve our yields, and make our people happier in their work, because compliance ensures that everyone knows what he has to do to ensure quality," says David Erdman, director of quality at DuPont Electronics based in Barleyville Plaza, Del. The company has had 15 of its 34 manufacturing sites certified, with the rest to follow by the end of this year. Not one of the certified plants has failed a vendor audit, Erdman says.

UNFORTUNATELY, relatively few U.S. companies have embraced ISO 9000. Despite the many recent seminars and conferences on the subject, the U.S. electronics industry is far behind the power curve of worldwide acceptance for ISO 9000. Tens of thousands of European companies have had their factories certified, but fewer than 400 U.S. companies can say the same, says Mark Morrow, senior editor of *Quality Systems Update* magazine in Fairfax, Va. Even worse, many U.S. companies may be unable to provide evidence of compliance—a lesser requirement that many European companies will accept in lieu of actual certification. The *Electronics Purchasing* poll shows that 42% of the respondents had no knowledge of ISO 9000 standards, and just 27% were setting up programs to comply.

With unification of Europe just around the corner, interest is reaching a crescendo, however. The best evidence is the torrent of inquiries

## The ISO 9000 quality debate rages on

**PRAISED by many as a good work-a-day foundation for world-class quality, ISO 9000 is seen by others as hopelessly out of step with today's quality requirements.**

**"I wouldn't build a good-sized doghouse based on ISO 9000," says consultant Capers Jones of Software Productivity Research in Burlington, Mass. "It would have been a good standard 10 years ago, but now it's just pablum."**

**The rap on ISO 9000 is many-faceted. Unlike the Malcolm Baldrige National Quality Award, the criteria deal only with production and service, leaving out marketing, engineering, and other disciplines. It does not require evidence of actual product quality, since it only ensures that policies and processes are in place to make such an outcome possible.**

**Many of those who have been through the process have a different take. "I was skeptical at first, but it's given us one helluva good baseline," says Joel Beck, vice president of U.S. manufacturing for Bull HN Information Systems Inc. in Billerica, Mass. By driving improved documentation and process control, ISO 9000 helps personnel understand and get involved in quality improvement. Since it is usually customer-driven, it puts quality at the forefront of the buying decision.**

**ISO 9000 is "a way for customers to confidently judge the quality of an organization in a world where every company now claims to be quality conscious," says Tracy O'Rourke, CEO of Varian Associates Inc. in Palo Alto, Calif.** □

flowing into the offices of the 18 ISO 9000 registrars in the U.S. and the 1,100 or so in Europe. "U.S. companies have finally awakened to the big push in Europe," says Richard Kleckner, president of Quality Systems Registrars Inc. in Naperville, Ill. "The attitude seems to be, 'If I'm thinking about ISO 9000, why not get the actual certification and do it before the competition?' "

The problem is that time may be running out on those who want to be first on their block with an actual ISO 9000 plaque. While registrars are rushing to train additional auditors to handle the work load, sources report a one- to four-month backlog and almost all expect that to reach a year or more as the deadline looms. Companies that are not already well into the certification process, registrars say, may have trouble reaching their goal by year-end.

GIVEN THESE constraints, experts advise vendors to get close to customers to learn their requirements regarding ISO 9000 and to lay out a road map to meet their needs. Above all, don't panic, says Sarah Hagigh, an international trade specialist with the Office of European Community Affairs in the Commerce Department. The recipient of about 125 often frenzied phone calls a week from worried industrialists, she says that "everyone should stop getting so fixated on this. Get a copy of the directives to figure out if your product is regulated, try to get hold of draft directives as they come out, shop around for the best registrar, and do your homework." The EC directives can be obtained from the American National Standards Institute at (212) 302-1286.

Choosing a registrar is especially mind-numbing. Thanks to the failure of the EC nations to create a single pan-European accreditation program, there is no single registrar that can ensure ISO 9000 compliance there, let alone around the world. Until that occurs—and few expect it to happen for at least a few years—each nation will have its own accrediting agency and its own stable of registrars. Although none of these accrediting bodies recognize each other, they do allow their registrars to sub-contract auditing and even certification services to registrars in other nations.

If your company has a European subsidiary, your best approach will be to get certified by a registrar accredited by the appropriate agency in that country. In Britain, for example, the de facto choice is the British Standards Institute (BSI), which has registered more than 8,500 of the 11,000-plus ISO certificates granted to date in that country. BSI is accredited by the National Accredita-

## Europe tries to get its house in order

**AFTER FIVE YEARS of negotiation, the 12 nations of the European Community (EC) still can't agree on a pan-European accreditation program for ISO 9000. As a result, the authority of an ISO 9000 certificate rarely extends beyond the country in which it was granted. An ISO 9000 system throughout Europe could be five years off or more, according to Jacques MacMillan, an EC official in charge of testing and certification.**

**That puts U.S. companies in a bind. Without knowing who has the EC's blessing to bestow certification, U.S. companies must either risk losing market share for noncompliance or invest time and money to get a certificate that may not meet all of their customers' needs. In this country, the confusion also has stifled the formation of new registrars—for-profit ventures that assess fees primarily on the market value of their accreditation. The result? There are only about 20 registrars in the United States, versus over 1,000 in Europe, which means that U.S. ISO 9000 aspirants must find ways to break into the busy schedule of these overseas registrars—and pay the higher fees associated with cross-Atlantic consulting.**

**Some observers see unintended obstructionism in all the EC debate on ISO 9000. "The Europeans will, of course, deny any bad intent, but they may erect effective barriers without even intending to," says George Lofgren, president of the Registration Accreditation Board of the American Society of Quality Assurance, which many believe will be America's internationally recognized accreditation program some day. By keeping the debate internally focused, says Lofgren, the Europeans could generate policies and procedures "that would make it more difficult for U.S. companies to compete in Europe."**

**The Europeans are making some progress in quelling such fears, however. A European Accreditation Commission was set up in 1991 to break down differences between the various accreditation boards, and EC officials have begun talks with the Commerce Department and other U.S. bodies to share information and come up with a mutual recognition agreement. Actual negotiations have not actually begun, however, and MacMillan doubts there will be such an agreement by year's end.**

**Another key step was taken last June when EC vice president Martin Bangemann signed an agreement with U.S. Commerce Secretary Robert Mosbacher that named the Commerce Department's National Institute of Standards and Technology (NIST) as the body that will ultimately identify which registrars would be recognized internationally to certify ISO 9000 aspirants in the United States for each EC directive. Still, the ball remains in the EC's court. "Before we can do our part, the Europeans have to figure out what they want," says Maureen Breitenberg, a standards specialist with NIST.** □

tion Council of Certification Bodies, which wrote the BS-5750 standard that, in large part, was adapted by the ISO to form the ISO 9000 standards. Another well-respected accrediting body is Raad vor Certificatie in the Netherlands, which is credited with designing the most widely used accreditation methodology.

For sites on U.S. soil, here are the options:

- Contract for certification with the U.S. arm of a well-established European registrar, such as Lloyd's Register Quality Assurance Ltd. in Manhattan or the National Standards Authority of Ireland in Merrimack, N.H., or with U.S. registrars who have been accredited by one of the various European accreditation bodies;
- Contract with the Underwriters Laboratory Inc. in Northbrook, Ill., which is not accredited but has an agreement with BSI and other foreign registrars to do ISO 9000 certification assessments on a sub-contract basis;
- Contract with one of three registrars accredited by the Registration Accreditation Board (RAB) of the American Society of Quality Control. RAB's first registrars are ABS Quality Evaluations in Houston, AT&T Quality Registrar in Allentown, Pa., and Quality Systems Registrars in Naperville, Ill.

While the RAB is not now recognized by the EC or any European government, it is rapidly positioning itself for acceptance once a pan-European program comes into being. In December, America's primary standards-making body, the American National Standards Institute, gave its stamp of approval to the RAB accreditation program, and RAB president George Lofgren is hopeful that negotiations with the U.S. Department of Commerce's National Institute of Standards and Technology will give the program the federal backing it would need for worldwide recognition. □

*Additional reporting by Barbara N. Berkman in London*

## Who to call to get ISO 9000 certification

(partial list of accredited assessors/registrars)

| Name | Number certified to date | Number under contract |
|---|---|---|
| **ABS Quality Evaluations**<br>Houston, TX<br>(713) 873-9400 | 3 | 20 |
| **American European Services**<br>Washington, DC<br>(202) 337-3214 | 2 | 2 |
| **AT&T Quality Registrar**<br>Union, NJ<br>(215) 770-3285 | 3 | 24* |
| **Bureau Veritas Quality International**<br>Jamestown, NY<br>(716) 484-9002 | 5 | NA |
| **DNV Industrial Services Inc.**<br>Houston, TX<br>(713) 579-9003 | 14* | 40 |
| **Intertek Services Corp.**<br>Fairfax, VA<br>(703) 273-4124 | 0 | 60* |
| **Lloyd's Registrar Quality Assurance Ltd.**<br>New York, NY<br>(212) 425-8050 | 14 | 88 |
| **MET Electrical Testing Co.**<br>Baltimore, MD<br>(301) 354-2200 | 14 | NA |
| **National Standards Authority of Ireland**<br>Merrimack, NH<br>(603) 424-7070 | 20 | 25* |
| **Quality Systems Registrars Inc.**<br>Naperville, IL<br>(708) 778-0120 | 6 | 20* |
| **SGS Yarsley Quality Assured Firms**<br>Hoboken, NJ<br>(201) 792-2400 | 2 | 5 |
| **TUV Rheinland of North America Inc.**<br>Newtown, CT<br>(203) 426-0888 | 0 | 5-6 |
| **Underwriters Laboratory Inc.**<br>**British Standards Institute**<br>Northbrook, IL<br>(708) 272-8800 | 39 | 200* |
| **Vincotte USA Inc.**<br>Houston, TX<br>(713) 465-2850 | 2 | 7 |

* estimated

Source: *Quality Systems Update* magazine and ELECTRONIC BUSINESS